SE2.8i - 3.8i - 4i - 5i

User's manual

Single-phase power grid-connected inverters

Siliken electronics

SILIKEN appreciates your support for our products.

We recommend that you read this instruction manual carefully in its entirely before handling the Inverter.

Safety

SAVE THESE INSTRUCTIONS – This manual contains important instructions of models SE5i, SE4i, SE3.8i & SE2.8i that shall be followed during installation, application and maintenance of the PV inverter.

Safety Precautions/Safety Notes

Only training-qualified personnel are allowed to perform the electrical installation, wiring, opening and repair of the SE inverters. Even if no external voltage is present, the SE inverters may still contain high voltage and the risk of electrical shock.

The temperature of the heat sinks outside of the device could exceed 70°C (158°F) in normal operation. There is the risk of burn injury by inadvertent contact.

The following general safety precautions must be observed during all phases of operation, service, installation and repair of this device. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the device. The manufacturer assumes no liability for the customer's failure to comply with these requirements.

Safety Symbols

To reduce the risk of injury and to ensure the continued safe operation of this product, the following safety instructions and warnings are marked in this manual.

Warning, risk of electric shock
Presents safety information to prevent injury or death to users and/or installers.

Caution (refer to accompanying documents)
Presents information to prevent damage to this product.

Earthground symbol

General Safety Precautions

• Training-qualified personnel are allowed to mount, reconfigure or repair this PV inverter. Also, licensed electricians are allowed to install and inspect the permanently-wired system.
• Remove all conductive jewelry or personal equipment prior to installation or service of the device, parts, connectors, and/or wirings.
• Ensure there is no grounding path through the human body. Well-insulated guards, e.g. insulated mat or shoes, are necessary when working the operating device.
• Use safety guard against risks of electrical shock or personal injury by any sudden component failure.
• Follow the instructions manual and all information on cautions or warnings must be adhered to.
• Use proper lifting techniques when handling enclosure, equipment or parts.
• The SE inverter is provided with an equipment-grounding conductor and a DC grounding connection. The grounded conductor may be ungrounded and energized when ground fault is indicated.
• The list does not contain all measures pertinent to the safe operation of the device. If special problems arise which are not described in sufficient detail for the purposes of the buyer, contact your specialized dealer or technician.

Safety Installation and Operation

• Installation of the device must be in accordance with the relevant electrical installations stipulated by local distribution network operator (DNO). Correct grounding, short-circuit and/or overcurrent protection must be provided to ensure operational safety.
• Read all instructions and cautionary remarks in the manual before installation.
• Switch off the circuit breakers before installation. Keep dry when working the inverter.
• It energizes when the PV arrays are exposed to light. Cover the arrays with opaque (dark) material before installation.
• Check both AC and DC connections with a digital voltmeter prior to any installation or removal procedures.
• Attach the outer cover correctly before switching on the circuit breakers.

• Install the inverter out of direct sunlight.
• Risk of electrical shock may be contained even if no external voltage is present.
• Allow at least 5 minutes for the inverter to discharge completely after disconnecting the AC and DC sources from the inverter.
• The temperature on the external heat sink may be high in normal operation and cause skin burn injury when touched. Pay attention to high temperature components.
• Prevent the risk of fire hazard, do not cover or obstruct the heat sink.
• Allow modification in your electrical system to be carried out only by the training-qualified electricians.

Repair and Maintenance

The SE inverter contains no user serviceable parts, except for the fan and the GFDI fuse. Only personnel trained and authorized by SILIKEN ELECTRONICS are allowed to carry out internal repair and maintenance of the unit. Please return the device for overhaul if some fault is caused by parts other than the fan and the fuse described above. For the replacement of the fuse, please refer to the section 5.3.

WARNING!
Not to make alterations or use tampering assembly in the inverter without manufacturer's authorization unless specified elsewhere in this Manual. They may result in injury, electric shock, or fire and void the warranty.

Wiring the inverter

• Input/Output Terminals: Use wire size #10 AWG to #6 AWG, 90°C (194°F) Copper Wire.
• Reconfirm all connections and screws have been made correctly and tightened properly.

WARNING!
All electrical installation and the wiring methods shall be done according to the relevant electrical installations stipulated by local distribution network operator (DNO) and should follow the important safety instructions in this manual.

Connection of the AC cable

WARNING!

Reconfirm the circuit breaker connected to the main utility is switched OFF before connecting the power cable from the breaker to the AC connector.

Connection of the DC cable

CAUTION!

Identify the different polarity of DC voltage on each PV string and connect respectively to the input terminals marked “UNGROUNDED CONDUCTOR” and “GROUNDED CONDUCTOR”. Make sure the DC voltage that PV arrays generate is equal to or less than 600 VDC in any case.

WARNING!

Route the DC connection cables to the SE inverters away from any possible hazards that could damage the cables.

WARNING!

Hazardous voltage is still present on the device after disconnection of all PV DC inputs. Allow five (5) minutes for the inverter to discharge the energy stored in capacitors completely.

WARNING!

PV arrays will be energized when exposed to light. Cover the arrays with opaque (dark) materials during installation and wiring.

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1.1 General

The Siliken Electroncis SE product family is a series of grid-connected photovoltaic inverters which are designed to convert DC power generated by photovoltaic arrays to AC power that is delivered to the home loads and then fed into the utility grid with any excess power. The SE 2.8i, SE3.8i, SE 4i, and SE 5i are the members of the family for the European market. The overview of the grid-tied solar energy system is shown in figure 1.1.1. SE inverters utilize state-of-the-art technology, reliability and ease of use and comply with the requirements of VDE0126-1-1, DK5940, RD1663, RD661 and EN50178 regulation.

The SE inverter is designed to operate automatically once it is installed and commissioned correctly. When the DC input voltage generated by the photovoltaic array rises above the pre-set threshold value, the embedded controller starts and goes through System Check mode and then into Monitoring mode until the PV Start Voltage is reached. During this time, the SE inverter will not generate AC power. Once all conditions necessary for grid connection are satisfied, the SE inverter goes into the Grid/MPP mode and begins feeding the AC power into the grid. When the input DC voltage falls below the minimum MPP voltage setting, the SE inverter will stop feeding AC power into the grid and return to monitoring mode. The SE inverter will enter the Grid/MPP mode again should the input DC voltage rise above the PV Start Voltage and all conditions necessary for grid connection are satisfied.

We appreciated your choice of Siliken Electronics SE inverters for your power conversion devices in your solar power system. This document contains the information you need for the installation and settings of the SE inverters. Therefore, it is strongly recommended to read this manual carefully before the SE inverter installation and settings.

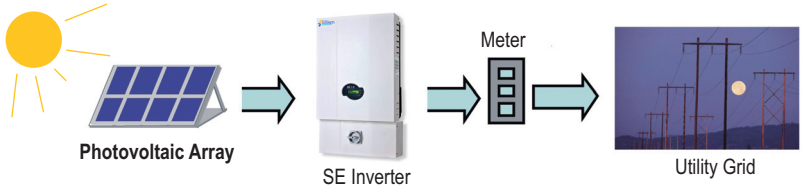


Fig. 1.1.1 Grid Connected Solar System Overview

1.2 Specifications

DC Input	SE2.8i	SE3.8i	SE4i	SE5i
Maximum DC power	3,3 kWp	4,5 kWp	4,8 kWp	6 kWp
MPP Voltage range	200-550 V_{DC}			
Maximum voltage range	600 V_{DC}			
Maximum current	15 A	20 A	22 A	25 A
Number of MPPT's	1			
Maximum number of Strings	3	4	4	4

AC Output	SE2.8i	SE3.8i	SE4i	SE5i
Nominal power	2,8 kW	3,8 kW	4 kW	5 kW
Maximum power	2,8 kW	3,8 kW	4 kW	5 kW
Maximum effective current	12,2 A	16,6 A	17,4 A	21,8 A
Nominal voltage	230 VAC			
Nominal frequency	50 Hz			
Harmonic distortion (THD)	<3%			
Power factor	>0,99			
Galvanic insulation	Transformer			
Number of phases	Single phase			

Protections
Anti-island protection.
Protection against leakage currents.
Protection against reverse polarity.
Protection against short circuits.

General characteristics	SE2.8i	SE3.8i	SE4i	SE5i
Yield maximum	96,4%		96,5%	
Yield UE	95,4%	95,7%	95,8%	95,8%
Level of protection	IP 44			
Own consumption (stand by)	0,5 W			
Cooling system	Convection	Forced ventilation		
Display	LED / LCD			
Communications	RS232C / RS485			
Dimensions	768 x 454 x 175 mm.		768 x 454 x 210 mm.	
Weight	23 Kg.		28 Kg.	
Operating temperature	-20ºC a +55ºC (without derating)			
Ambient humidity	Maximum 95%			
Integrated DC disconnector	Optional			
Type of DC connection	Bolted terminal / MC4			
Type of AC connection	Bolted terminal			

Standards
CE Marking.
Electrical Safety Directive EN 50178.
Electromagnetic Compatibility Directive
EN 61000-6-4: EN 55011
EN 61000-6-2: EN 61000-4-2
EN 61000-4-4
Complies with RD 661/2007, RD 1663/2000, DK 5940 and VDE 0126-1-1.

Due to our continuous improvement policy, these specifications are subject to change without prior notice.

1.3 Adjustable Parameter Settings

This new series of SE inverters have, currently, three models to fulfill the market needs for the countries of Germany, Italy, and Spain. It can be distinguished by the model names described as followings:

- SE xxE: For Germany
- SE xxE-IT: For Italy
- SE xxE-ES: For Spain

Parameter	Germany	Italy	Spain
Model name	SE xxE	SE xxE-IT	SE xxE-ES
Standard	VDE0126-1-1	DK5940	RD1663, RD661
Over-voltage (VAC)	260.0	262.0	253.0
Under-voltage (VAC)	190.0	188.0	196.0
Over-frequency (Hz)	50.19	50.3	51.0
Under-frequency (Hz)	47.51	49.7	48.0
Over-voltage clearing time (cycle)	8	4	8
Under-voltage clearing time (cycle)	8	9	8
Over-frequency clearing time (cycle)	5	3	5
Under-frequency clearing time (cycle)	5	3	5
Voltage quality monitoring* (VAC)	253.0	257.6	250.7
Voltage quality monitoring time* (s)	300	0 (NA)	0 (NA)
Reconnect delay (s)	20	20	180
PV start voltage (VDC)	235.0	235.0	235.0

* The period of time for the SE inverter to disconnect from the grid and enter the Monitoring mode after the detection of the AC voltage that is higher than the **Voltage quality monitoring** setting and below the **Over-voltage** setting. This function is available only in the models of Germany type according to the VDE 0126-1-1, Clause 4.2.3.

1.4 Accessories

- Operation Manual 1 pc
- Auto-Test software CD (SE xxE-IT only) 1 pc

2.1 Placement

1. SE inverters that must be vertically mounted may be located indoors or outdoors, according to protection class IP44.
2. Leave at least 50 cm (19.67 inches) of free space above and 100 cm (39.37 inches) below the inverter when installed outdoors. Allow 20 cm (7.87 inches) between inverters when installing multiple inverters for better ventilation (see figure 2.1.1).
3. Mount the inverter on a wall that shall be strong enough to sustain the inverter with 32 kg (70.5 lb) weight.
4. Avoid mounting the inverter on a location directly exposed to sunlight to maintain the ambient temperature of the inverter within -25°C and 65°C (-13°F and 149°F). Humidity shall be within 0% and 95%.
5. Keep DC wiring as short as possible to minimize power loss.
6. The mounting bracket should be fastened on a concrete or a masonry wall with the accessory anchors.

WARNING!

Do not expose the inverter to the corrosive liquids and/or gases.

WARNING!

Not to operate the inverter where it exposes to flammable, explosive environment or around combustibles like trash or unknown materials that may result in danger. Some parts of the cooling surface can reach temperatures over 70°C (158°F).

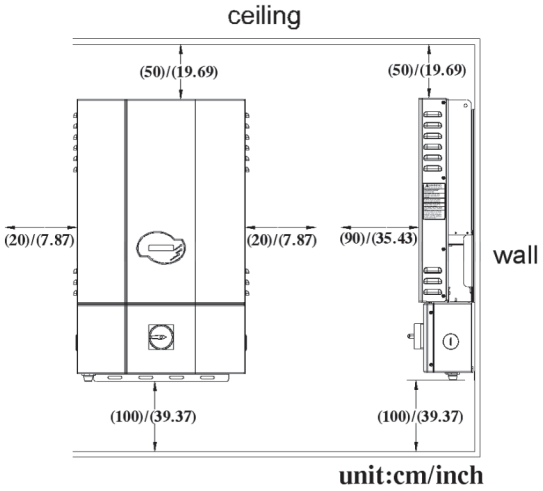


Fig. 2.1.1 Clearances required for SE inverter installation

2.2 Mounting

The steps listed below describe how to mount the inverter on the wall:

1. After removing the inverter from the carton, the attached mounting bracket must be removed by sliding the bracket down and away from the inverter as shown in the figure 2.2.1 below.

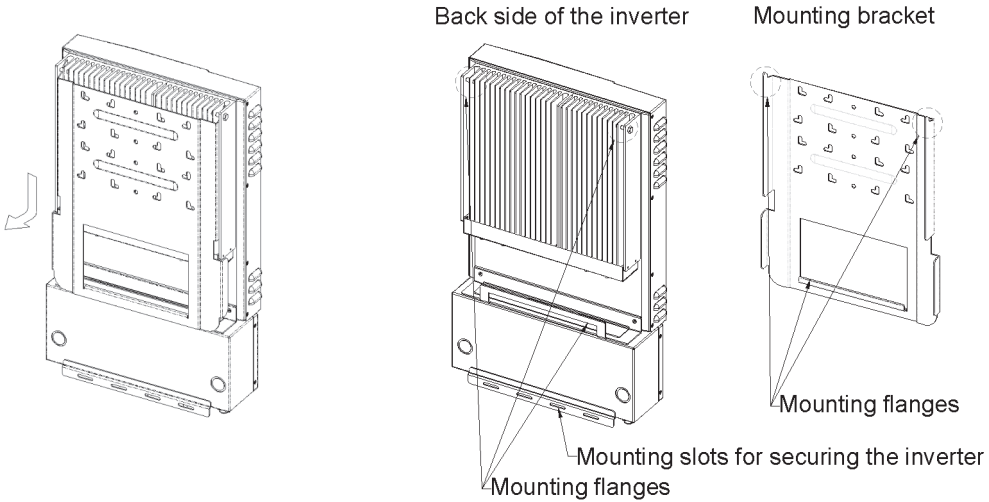


Fig. 2.2.1 Removal of the mounting bracket from the inverter

2. Use the mounting bracket (figure 2.2.2) as a template to mark the location of the holes to be drilled in the wall. After drilling the holes, the mounting bracket is then held against the wall and fastened to the wall with anchors as shown in the figure 2.2.3. (A minimum of three (3) screws is required)

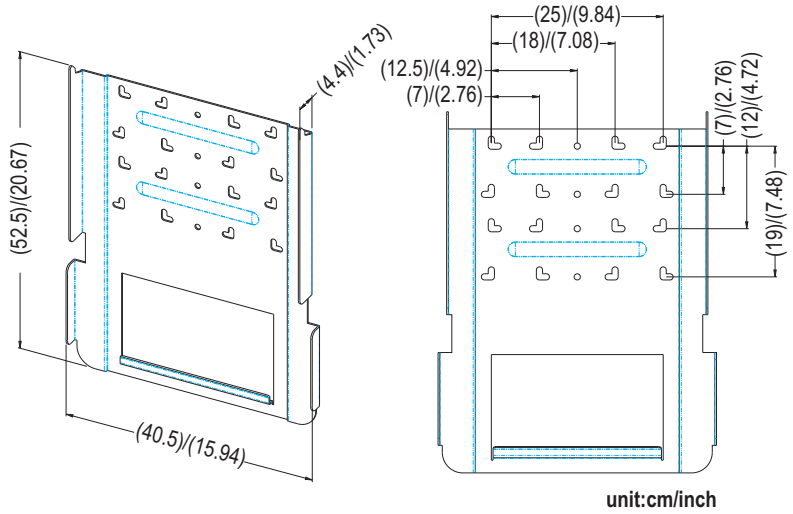


Fig. 2.2.2 Inverter mounting bracket

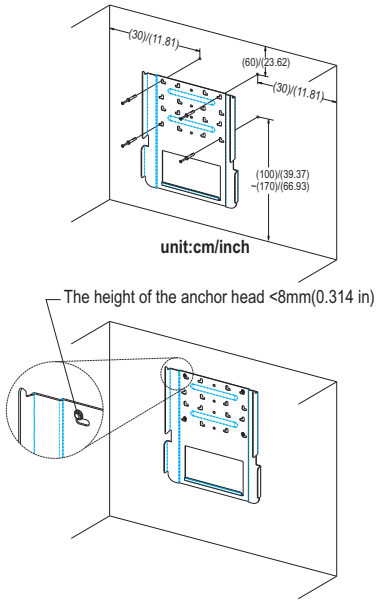


Fig. 2.2.3 Fasten the mounting bracket

3. Once the mounting bracket is attached to the wall, the inverter can be located and fastened to the mounting bracket. Slide the inverter over the mounting bracket flanges and down carefully to lock it in place. Attach the screw through the hole as shown in figure 2.2.4 below, used to fasten both inverter and the wiring box together to the mounting bracket.

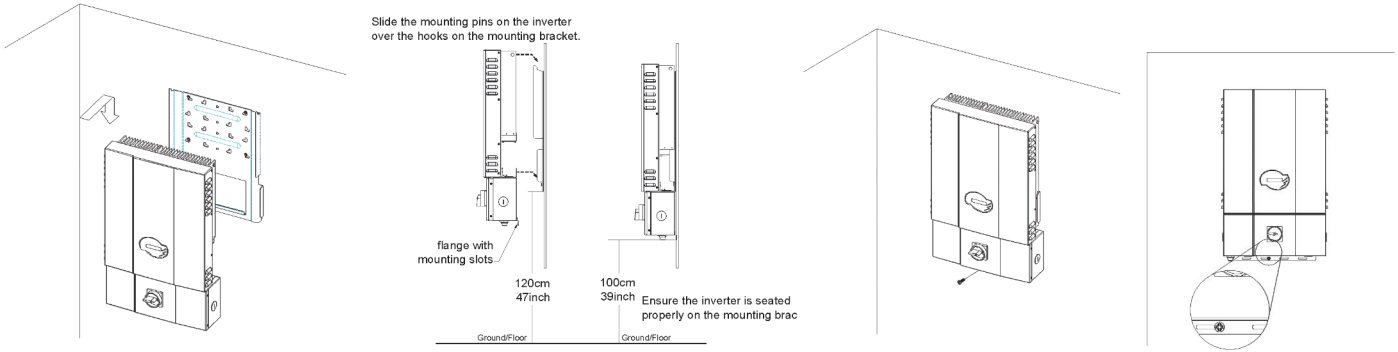


Fig. 2.2.4 Hook the Inverter on the mounting bracket and then fasten the screw

After the inverter is hung correctly on the bracket and secured with the screw, it is then possible to complete wiring for the inverter.

2.3 Wiring the inverter

The SE inverter is provided with four (4) (three (3) for SE 2.8i) independent PV strings to be connected in parallel in the wiring box. The wiring box of the SE inverter offers 3 options in DC cable connection, type DM, DS and S as shown in the figure 2.3.1. "**DM**" type wiring box has DC/AC disconnect switch and MC4 connectors built on the box. "**DS**" type wiring box has DC/AC disconnect switch built on, but there is no MC4 connectors for the DC wirings. "**S**" type wiring box has neither DC/AC disconnect switch nor MC4 DC connectors built on. Both **DS** and **S** types of wiring boxes have only screw terminals and cable glands for the DC wirings with the wire size in the range of #10 AWG and #6 AWG.

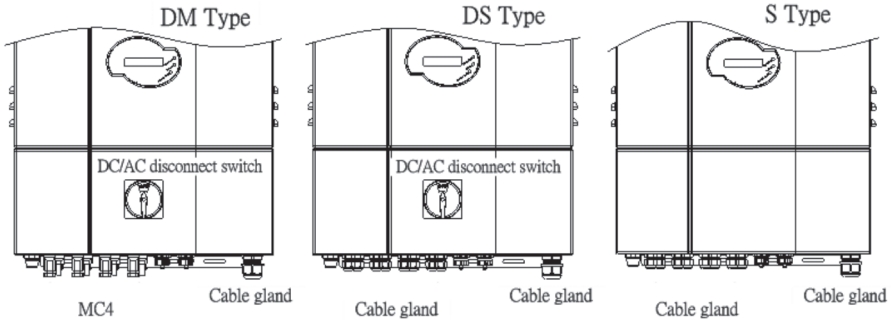


Fig 2.3.1 Wiring box type

It is necessary to remove the cover of the wiring box before wiring the inverter. If there is a DC/AC disconnect switch built on the wiring box, then the DC/AC disconnect switch shall be turned to the OFF position first as shown in figure 2.3.2. And then remove the screws, two on each side of the cover; remove the cover of the wiring box as shown in the figure 2.3.3 below.

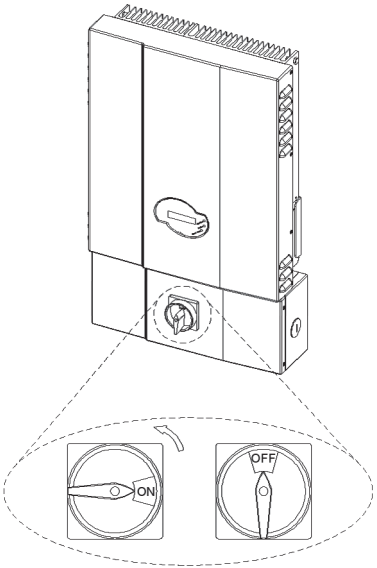


Fig 2.3.2 Turn the DC/AC disconnect switch OFF

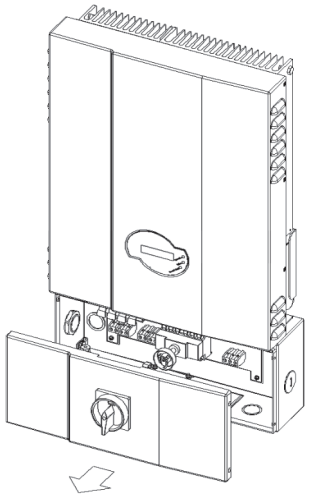


Fig 2.3.3 Remove the cover of the wiring box

In order to prevent from water, dust or any other unwanted foreign body, must stuff up all those unused cable glands (or MC4 connectors) with sealing pins (or MC4 sealing plugs), parts of accessories, when the wiring work is almost completed. See figure 2.3.4.

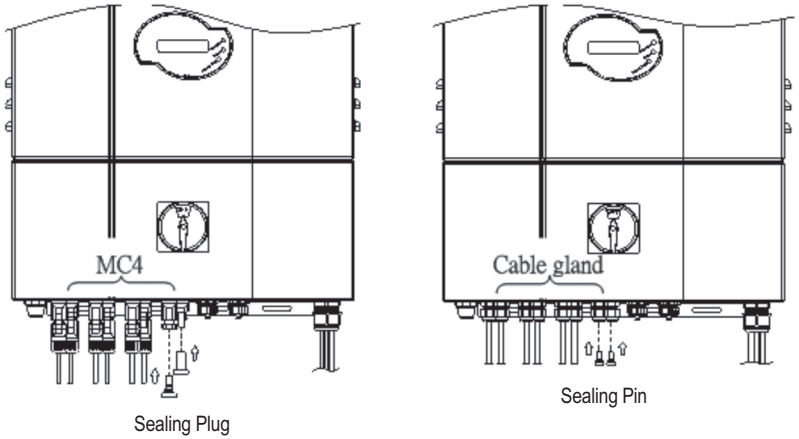


Fig 2.3.4 Sealing pins (plugs)

The following three sections describe the wiring for the AC, DC, and communication ports. The wiring shall be done in the wiring box for the SE 2.8i, SE 3.8i, SE 4i, and SE 5i. There is one (1) AC terminal block, a pair of DC terminal blocks and two (2) RJ-45 connectors in the wiring box as shown in the figure 2.3.5. The AC terminal block is used to connect to the utility grid through a circuit breaker and distribution panel according to national and local requirements. The DC terminal blocks are used to connect up to 4 PV strings in parallel in the wiring box. The RJ-45 connectors are used for external communication to a remote computer or terminal.

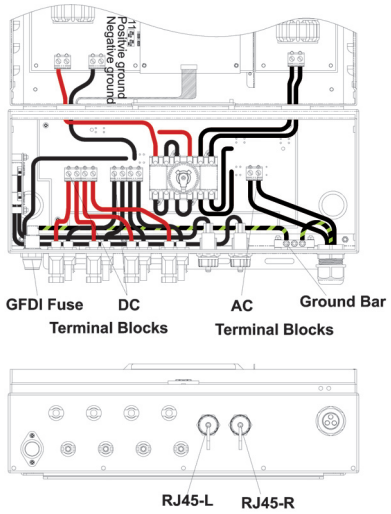


Fig 2.3.5 Wiring box front view

WARNING!

All electrical work shall be implemented in accordance the relevant electrical installations stipulated by local distribution network operator (DNO) and follow the important safety instructions in this manual.

WARNING!

Under the DNO's inspection authority a dedicated circuit breaker must be installed at the connection to the AC mains.

WARNING!

Make sure the suitable connecting cables are used for both the AC and DC wirings. The cable must be taken into consideration for its ampacity and weatherproof like temperature fluctuation and UV radiation, etc. Use #10 AWG to #6 AWG, 90°C (194°F) copper wire for all AC and DC wiring connections to the SE inverter.

WARNING!

PV arrays will be energized when exposed to light. Cover the arrays with opaque (dark) material during installation and wiring.

2.3.1 Connection of the AC cable

Use the following procedure to wire the AC cables.

1. Open the Distribution panel and switch off the circuit breaker used to connect the inverter to the grid.
2. Use #10 AWG to #6 AWG, 90°C (194°F) copper wire for all AC wiring connections to the SE inverter.
3. Connect the cable GND to the screw of the ground bar labeled ⏚

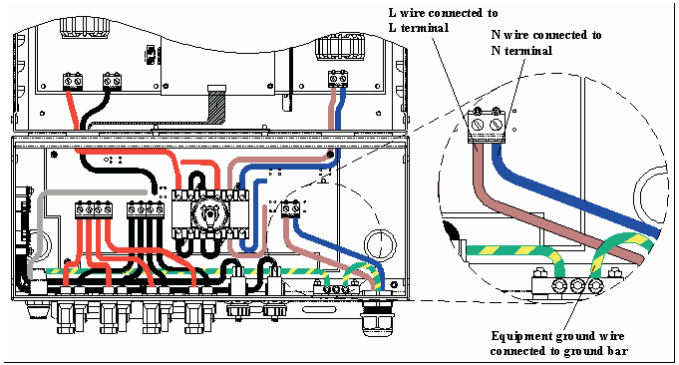


Fig 2.3.1.1 AC Terminal Block for AC cable connections

4. Connect the cable L to the terminal labeled L of the AC terminal block.
5. Connect the cable N to the terminal labeled N of the AC terminal block.
6. Tighten the screws with a torque of 1.7Nm (15.6 in-lb).
7. Reconfirm that all connections have been performed properly as described above and all screws are properly tightened.

WARNING!

Reconfirm that the circuit breaker to the main utility is switched OFF before connect the power cable from the breaker to the AC terminal block.

CAUTION!

Ensure that the total impedance of the grid and the interconnected AC power cable shall be less than 1.25 Ω.

WARNING!

According to the relevant electrical installations stipulated by local distribution network operator (DNO), each connection to a SE inverter must be installed with a dedicated double-pole circuit breaker in the main utility service panel. The breaker must be sized to handle the rated maximum output voltage and current of a SE Inverter. Refer to Section 1.2 Specifications: Output over current protection, pages 3 - 6. No other appliances may be connected to the circuit breaker.

2.3.2 Connection of the DC cable

The wiring box of the SE inverter is designed to have a pair of the DC terminal blocks which support up to four (4) (three (3) for SE 2.8i) independent PV strings to be connected in parallel in the wiring box and then feed into the inverter. For the SE inverter with DM type wiring box that has MC4 built on, the wirings between MC4 connectors and DC terminal blocks have been accomplished in manufacturing.

CAUTION!

SE inverters are listed for no backfeed current. However, all other external source circuits and array wiring ampacity should be taken into account by system installers when determining the proper rating of PV string fuse, or a fire hazard may occur if there is short-circuit in a PV string.

There are two (2) terminals, labeled UNGROUNDED CONDUCTOR and GROUNDED CONDUCTOR, per PV string located in the wiring box

used for the DC cable connections. All the screws shall be tightened with a torque of 1.7Nm (15.6 in-lb).

Up to four (4) (three (3) for SE 2.8i) independent PV strings (4 pairs) can be connected to the SE inverter as shown in the figure 2.3.2.1. The PV strings will be connected in parallel in the wiring box.

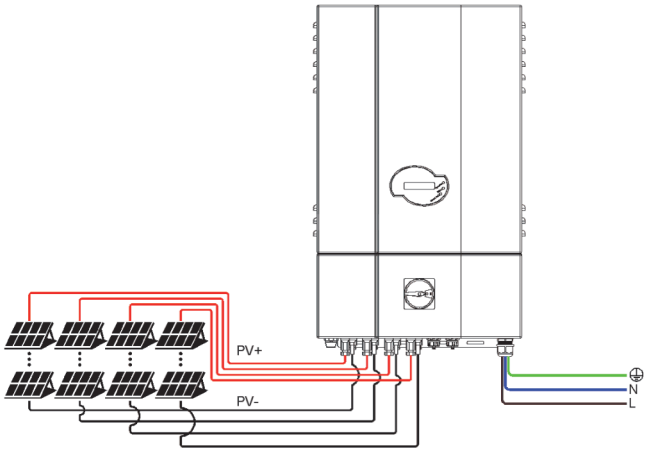


Fig 2.3.2.1 PV-terminal connection

The SE inverter supports both negative and positive ground for PV strings connections. The JP14 and JP15 jumpers are used for the settings of the negative and positive ground.

CAUTION!

When PV arrays are energized when exposed to light, it supplies a dc voltage to the inverter. Bear in mind the safe working practices are followed.

WARNING!

Route the DC connection cables to the SE inverters away from any possible hazards that could damage the cables.

WARNING!

Hazardous voltage is still present on the device after disconnection of all PV DC inputs. Allow 5 minutes for the inverter to discharge the energy stored in capacitors completely.

2.3.2.1 Connection of the DC wires for Negative Ground Arrays

Once the SE inverter is shipped with negative ground setting, it is set as shown in the figure 2.3.2.1.1. The JP14 and JP15 jumpers are placed on the lower positions to set to the negative ground and the red DC wire is connected to the DCIN+ terminal, the black DC wire is connected to the DCIN- terminal. In this case the positive polarity of the DC input voltage from the PV string shall be connected to the terminal labeled UNGROUNDED CONDUCTOR and the negative polarity of the DC input voltage from the PV string shall be connected to the terminal labeled GROUNDED CONDUCTOR as shown in the figure 2.3.2.1.2.

CAUTION!

Identify the different polarity of DC voltage on each PV string and connect respectively to the input terminals marked “UNGROUNDED CONDUCTOR” and “GROUNDED CONDUCTOR”. Make sure the DC voltage that PV arrays generate is equal to or less than 600 VDC in any case.

• The “+” cable of the DC input voltage shall be connected to the terminal labelled UNGROUNDED CONDUCTOR and the “-” cable of the DC

input voltage shall be connected to the terminal labelled GROUNDED CONDUCTOR.

• Avoid using wire nuts to join any wires together or to make any connections anywhere in the PV system. Wire nuts are a frequent cause of unreliable connections, resistive connections, and ground faults.

• Tighten the screws with a torque of 1.7Nm (15.6 in-lb).

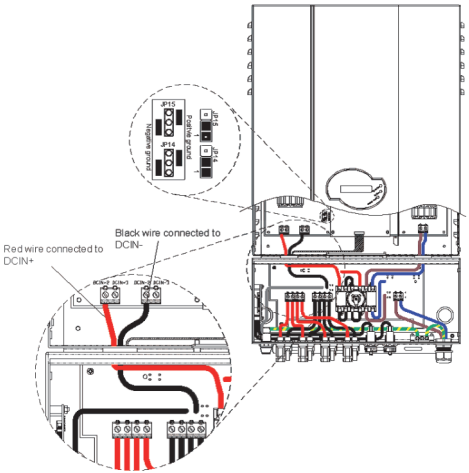


Fig 2.3.2.1.1
Negative Ground Setting and DC wires connections

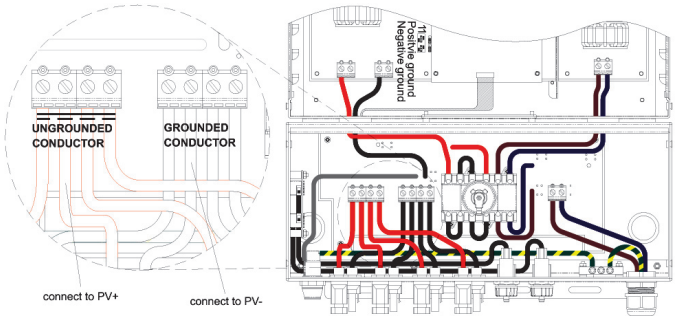


Fig 2.3.2.1.2
DC terminal blocks for DC cable connection in Negative Ground

2.3.2.2 Connection of the DC wires for Positive Ground Arrays

The SE inverter also supports PV arrays with positive ground for some applications. As shown in the figure 2.3.2.2.1, the JP14 and JP15 jumpers are placed on the higher positions to set to the positive ground. And the red DC wire is connected to DCIN- terminal and the black DC wire is connected to DCIN+ terminal. In this case the positive polarity of the DC input voltage from the PV string shall be connected to GROUNDED CONDUCTOR terminal and the negative polarity of the DC input voltage from the PV string shall be connected to UNGROUNDED CONDUCTOR terminal as shown in the figure 2.3.2.2.2.

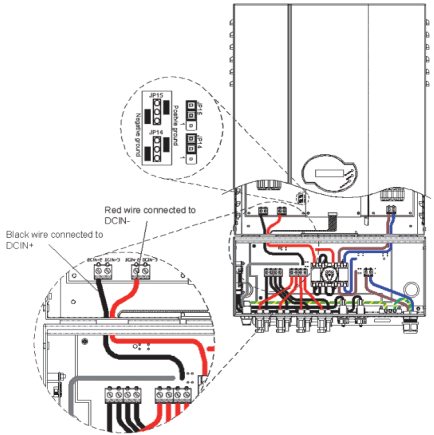


Fig 2.3.2.2.1 Positive Ground Setting and DC wire connections

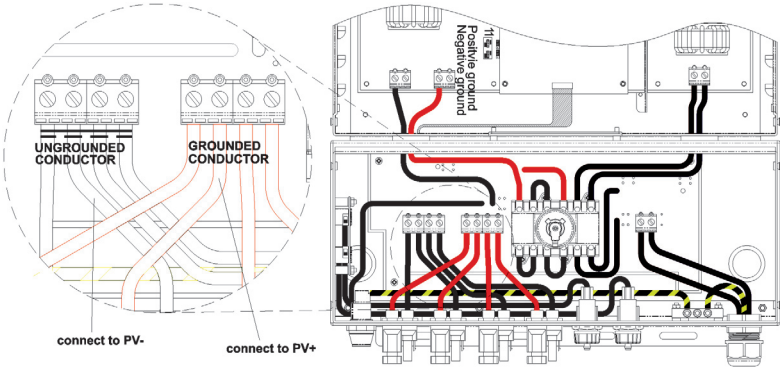


Fig 2.3.2.2.2 DC terminal blocks for DC cable connection in Positive Ground

CAUTION!

The Positive Polarities of the DC input voltage from a PV string shall be correctly connected to the “GROUNDED CONDUCTOR” terminal and the Negative Polarity of the DC input voltage from a PV string shall be connected to the “UNGROUNDED CONDUCTOR” terminal. Make sure the DC voltage that PV arrays generate is equal to or less than 600 VDC in any case.

• The “+” cable of the DC input voltage shall be connected to the terminal labelled “GROUNDED CONDUCTOR” and the “-” cable of the DC input voltage shall be connected to the terminal labelled “UNGROUNDED CONDUCTOR”.

• Avoid using wire nuts to join any wires together or to make any connections anywhere in the PV system. Wire nuts are a frequent cause of unreliable connections, resistive connections, and ground faults.

• Tighten the screws with a torque of 1.7Nm (15.6 in-lb).

2.3.3 Connection of the Communication cable

The SE inverter supports two common data interface standards, RS-232 and RS-485 that will be used to communicate to the remote computer or terminal. Only one of the communication interfaces can work at a time. As shown in the figure 2.3.3.1, there are two RJ-45 connectors (RJ45-L and RJ45-R) located on the bottom of the wiring box. The pin numbers of the RJ-45L and RJ-45R connectors and the corresponding signals are described in the figure 2.3.3.2 below.

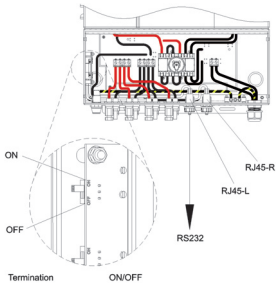


Fig 2.3.3.1
Positions of the communication ports and termination switch

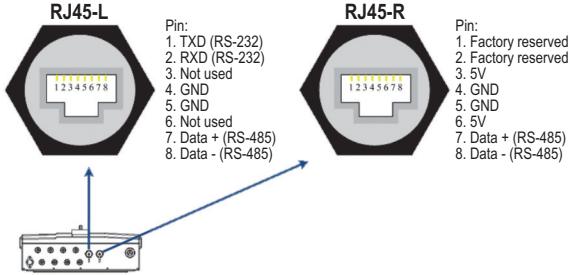


Fig 2.3.3.2 RJ-45 Pins and Signals

The RS-232 signal pins, TXD and RXD, are only on the RJ45-L. Therefore, only the RJ45-L can be used to connect to one remote PC or terminal when the RS-232 interface is used. The cable with the part number of WABG-0918S, which is 180 cm (70.9 inches) in length, is dedicated for the communications between SE inverter and a computer. Its wire connection between RJ45 and RS-232 is shown in the figure 2.3.3.3.

If the RS-485 interface is used as the external communication interface, both RJ-45 connectors will be used for the cascaded RS-485 connections as shown in the figure 2.3.3.4. If the inverter is the last device within the RS-485 loop, then the termination switch shall be put to ON position (shown in the figure 2.3.3.4). Users shall open the front lid of the wiring box to switch the termination switch to ON position. The termination switch is default set to OFF position.

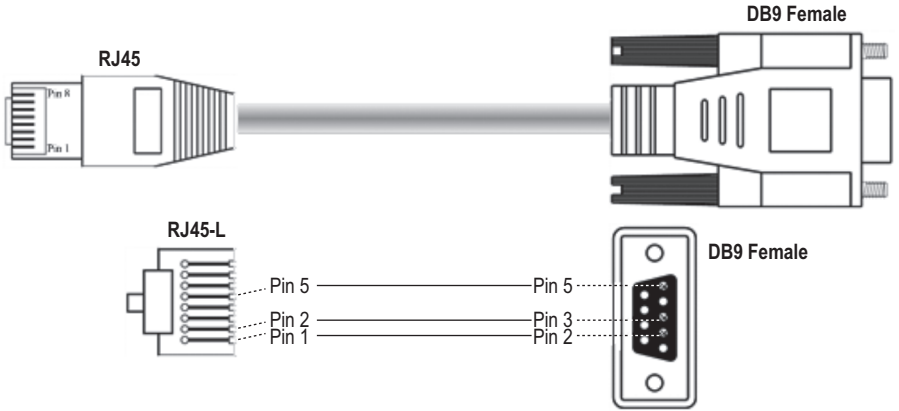


Fig 2.3.3.3 RS-232 connection

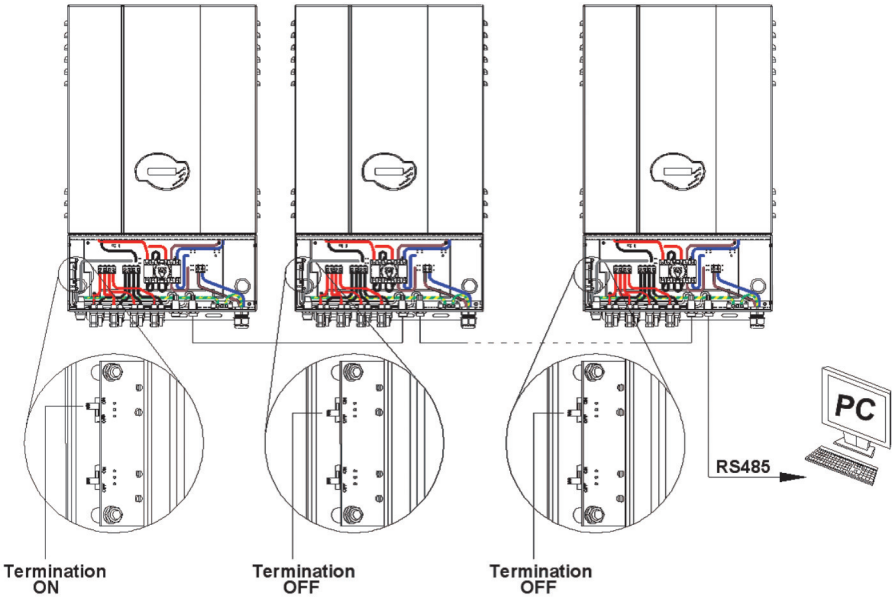


Fig 2.3.3.4 RS-485 connection

2.4 Wiring inverter in parallel

SE inverters can be connected in parallel when more power is required. In the parallel configuration, each inverter shall connect to its own PV array. It is not recommended to connect one PV array to more than one inverter. This may cause the inverter to work abnormally. The figure 2.4.1 below shows the connections between inverters and PV arrays in parallel configuration.

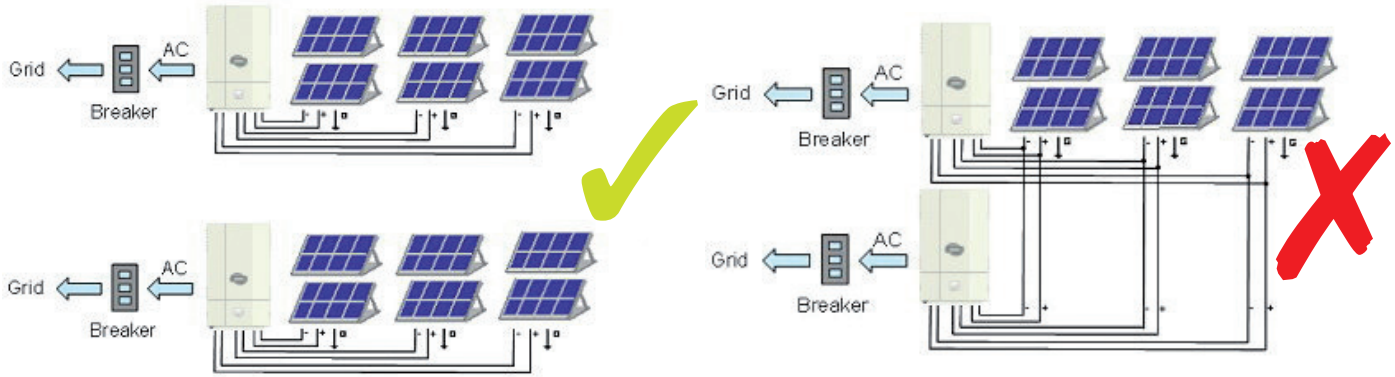


Fig 2.4.1 Parallel configuration of inverter

3.1 Overview

The SE inverter will operate automatically. Once the insolation is strong enough to generate DC input voltage over the pre-set threshold value, the inverter turns itself on. The inverter feeds power into the grid after input voltage over the PV start voltage and all necessary conditions are checked and fulfilled. The inverter goes into Monitoring mode from the Grid/MPP mode if the DC input voltage is under the minimum MPP voltage. Once the DC input voltage falls below the pre-set threshold value, the inverter will shut down itself. There are five main operating modes described in detail below.

System Check: When the DC input voltage goes above the PV start voltage, the inverter is powered-up and initial, and then enters the System Check mode. In this operating mode, the inverter runs diagnostics. This stage takes only a few seconds.

Monitoring: After System Check is complete the inverter enters the Monitoring mode. In this operating mode, the inverter monitors all parameters on both AC and DC sides in order to insure that connecting to the mains is safe. All conditions must be fulfilled and last for a certain period of time, then the system will enter the Grid/MPP mode.

Grid/MPP: After the Monitoring mode, the SE inverter confirms that all conditions necessary for feeding the power into the utility grid are fulfilled. The inverter will turn on the AC relays and start feeding the AC power to the grid. In this operating mode, the inverter continues to convert the DC power generated by the PV array to the AC power that is then fed into the grid.

Fault: When fault(s) occurs and have been detected in the operating mode described above, the inverter will terminate the present state, stop feeding power to the grid, and then jump into the Fault mode that executes a preset sequence. When the faults have been cleared for certain period of time, the inverter will leave Fault mode and enter System Check mode. Some faults, like component failure, will cause the inverter go into the Idle mode that will need service staff to clear the error(s).

Idle: Once the inverter jumps into this operating mode, the inverter has detected a malfunction of the ENS and has stopped feeding the power

to the grid for safety reason. Normally this is a failure that cannot be removed on field. It needs service personnel coming to remove the problems and put the system back to operation.

3.2 Operation Feature

Anti-Island:

When an “island” condition is detected, the inverter will stop feeding the power to the grid and/or the load. The “island” is defined as a grid tied inverter maintaining operation and feeding power to a load that has been isolated from the utility power source. This causes an automatic shutdown of the inverter when there is an electrical disturbance on the utility grid. This is a safety feature which is primarily meant to prevent electrical shock to staff who might be working on the grid wires.

Unity Power Factor:

The SE inverter intend to feed the power with a unity power factor (PF = 1) to the utility during operation. The inverter continues sensing the phase of the utility voltage, and constructs the output current waveform in phase with the utility voltage.

Maximum Power Point Tracking:
In order to find the most efficient way of utilizing the solar energy, SE inverters are designed to track and absorb the maximum power from the PV array. The Maximum Power Point Tracking (MPPT) function is employed in the embedded control software to achieve this intended purpose.

3.3 LED Indication

There are three LED’s on the front panel of the SE inverter which displays the operating status of the inverter. As shown in the figure 3.3.1. The detailed explanations of the status and the corresponding LED indicators are described in the following table.

Fig 3.3.1 Front panel of the SE inverter

Led indicators		Operating status	On Grid	Description
Green	☼	Initialization	N	The SE inverter is in initial mode.
Yellow	☼			
Red	☼			
Green	☼	System Check mode	N	The inverter is in System Check mode.
Yellow	●			
Red	●			
Green	☼	Monitoring mode	N	The inverter is in Monitoring mode.
Yellow	●			
Red	●			
Green	○	Grid / MPP mode	Y	The inverter is in Grid / MPP mode.
Yellow	●			
Red	●			
Green	☀	Power De-rating	Y	Power de-rating is performed.
Yellow	✕			
Red	●			
Green	✕	Warning	Y	Warning is detected.
Yellow	☀			
Red	●			

Led Indication Table:

○ Led On
● Led Off
✕ Don't Care
☼ Led On / Off 0.1 / 0.9 sec.
☀ Led On / Off 0.9 / 0.1 sec.
Led On / Off 0.25 / 0.25 sec.

Led indicators		Operating status	On Grid	Description
Green	⊗	1. Low Insolation 2. Vac high	N	1. The invertere is in low insolation. 2. Vac is higher than the voltage quality monitoring setting.
Yellow	●			
Red	●			
Green	●	Fault mode	N	The inverter is in Fault mode.
Yellow	○			
Red	×			
Green	×	Ground Fault	N	Ground fault detected.
Yellow	×			
Red	○			
Green	○	Idle mode	N	The inverter is in Idle mode.
Yellow	●			
Red	×			
Green	●	Night Time	N	There is no DC power coming from PV array. System is powered off.
Yellow	●			
Red	●			

Led Indication Table:

○ Led On
● Led Off
× Don't Care
⌧ Led On / Off 0.1 / 0.9 sec.
☼ Led On / Off 0.9 / 0.1 sec.
⊗ Led On / Off 0.25 / 0.25 sec.

3.4 LCD Display

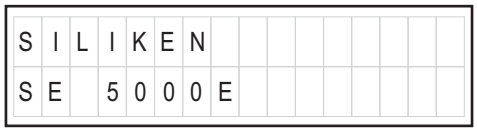
The SE inverter has a 2 x 16 LCD to show the operating status, input/output data, and error messages. As long as the DC input voltage is above the pre-set threshold value, the LCD will display the information following the process flow illustrated in the figure 3.4.1.

The process flow could be the regular procedure, fault procedure or idle procedure. The regular procedure is that the system goes from Initial, System Check, Monitoring, and then Grid/MPP mode without any fault condition detected. The inverter is expected to work in the regular procedure and feed the power to the grid. During the System Check and Monitoring mode and a fault condition that could be cleared automatically is detected then the system will go into the fault procedure. The system will return to regular procedure once the fault condition is cleared. One obvious example is that an “island” condition is detected due to the grid failure and later the fault condition is cleared when the power recovery. If a fault occurs that does not clear on its own then the system will enter the idle procedure which needs a service staff to clear the fault and reset the system. These three procedures are illustrated in the figure 3.4.1(page 49).

The following figures explain how the display works for the regular procedure.

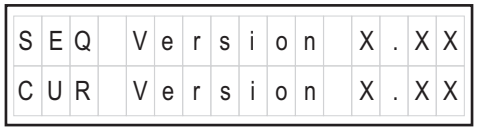
Initial Mode :

When the DC input voltage rises above the pre-set threshold value, the SE inverter is powered up and will show the company name and model name (SE 5000E in this example) on the LCD as shown below.

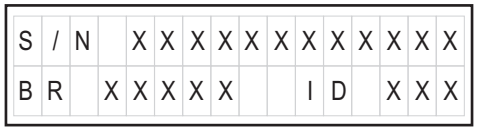


3 seconds ↓

After 3 seconds, software versions of two embedded CPU's, Sequential (SEQ) and Current (CUR) controller, will be displayed on the LCD. Afterward the serial number (S/N), the baudrate (BR) / address (ID) for the communication port will be displayed.



3 seconds ↓

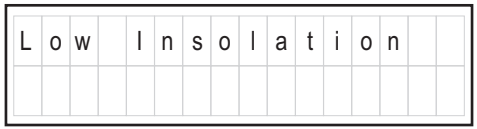


3 seconds ↓

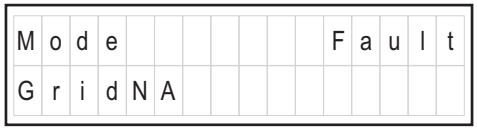
System Check Mode:

After the basic information of the inverter is displayed, the system enters the System Check mode which is then indicated on the LCD.

During the System Check, if the DC input voltage is not reaching the point of the PV start voltage setting, , then the following message will be shown on the LCD and the system will stay at this step.

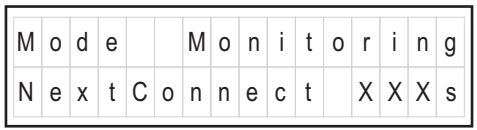


During the System Check, if the grid is not connected to the inverter, then the inverter enters to Fault mode and following message will be shown on the LCD.

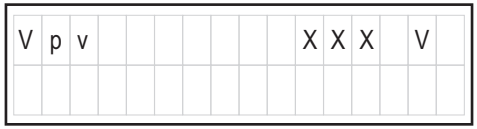


Monitoring Mode :

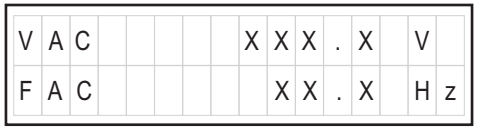
Once the System Check is done, the inverter goes into the Monitoring mode. If all data needed for grid feeding is in the acceptable range, the system will keep monitoring those data for a period of time. The following information tells users that the system will go into the Grid/MPP mode in XXX seconds late and then show the measured data of the DC input voltages and the existing voltage and frequency on the grid side.



3 seconds ↓

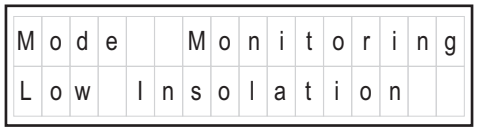


3 seconds ↓

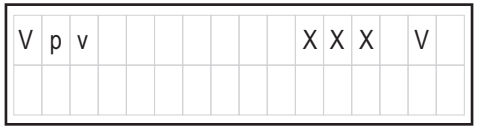


3 seconds ↓

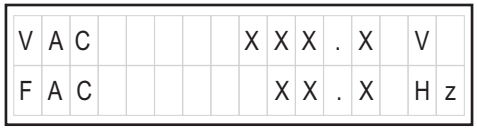
During the Monitoring mode, if DC input voltages fall under the PV start voltage setting, the system stays in this mode and shows the information as follows. The system will still keep measuring the parameters of both DC and AC and display on the LCD.



3 seconds ↓

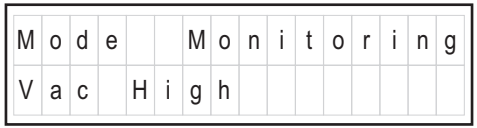


3 seconds ↓

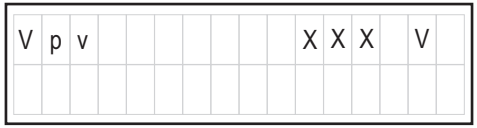


3 seconds ↓

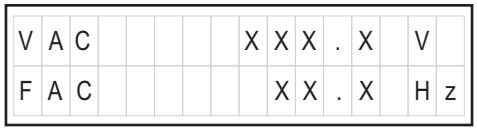
For SE xxxxE (Germany type), according to VDE0126-1-1, if the AC voltage on the grid side increases and over the voltage quality monitoring setting and below the over voltage setting for at last 300 seconds in grid/MPP mode, the SE inverter shall return to Monitoring mode and display the messages on the LCD as shown below. If the AC voltage decreases and below the voltage quality monitoring setting for at last 300 seconds, SE inverter will then go back to regular procedure and re-connect to the grid if all conditions are satisfied.



3 seconds ↓



3 seconds ↓

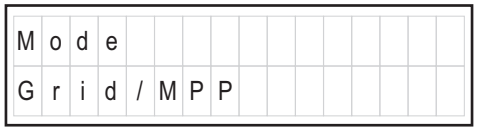


3 seconds ↓

Grid/MPP Mode :

After the system enters the Grid/MPP mode, it will show the following information in order and repeatedly until the system goes to other operating mode.

The first screen shows the current operation mode.



3 seconds ↓

Next messages are the up-to-minute data of the input / output voltage and power. First two messages are for the PV arrays and the other two messages are for the output. Vpv is the incoming voltages from PV array. Wpv is the incoming power of PV array in watts. Vac, Pac, Iac, and Fac are the voltage, power, current, and frequency that the inverter feeds to the grid.

V	p	v							X	X	X		V		
W	p	v						X	X	X	X		W		

3 seconds ↓

V	A	C					X	X	X	.	X			V	
P	A	C						X	X	X	X			W	

3 seconds ↓

F	a	c						X	X	.	X		H	z	
I	a	c						X	X	.	X		A		

3 seconds ↓

3 seconds ↓

The next message shows the cumulated energy in kWh and period of time in hours for the inverter delivering the power to the grid since the inverter has been power on and operated for today.

E	t	o	d	a	y		X	X	X	.	X		k	W	h
H	t	o	d	a	y			X	X	.	X		H	r	

3 seconds ↓

The next message shows the cumulated energy in kWh and period of time in hours for the inverter delivering the power to the grid up-to-date since the inverter has been installed and operated.

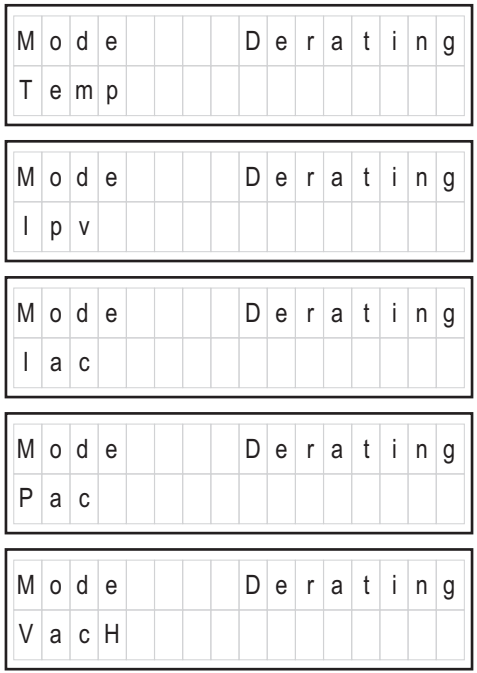
E	a	c		X	X	X	X	X	X	.	X		k	W	h
H							X	X	X	X	X		H	r	

3 seconds ↓

Power De-Rating Message :

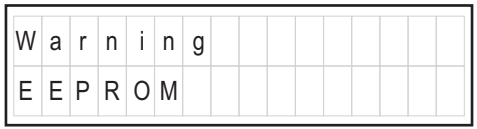
There are five possible de-rating displays which will be shown if power de-rating is detected in Grid/MPP mode. Only one occasion that causes de-rating could be detected at a time. Therefore, only one of the following messages will be displayed if power de-rating occurs. When **Temp**

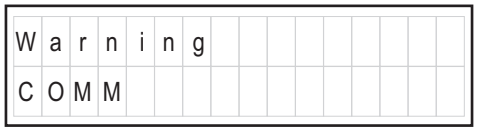
message is presented, the power de-rating is caused by the over temperature. The **Ipv** message shows that the power de-rating is caused by restricting the DC input current to the maximum limit. The **Iac** and **Pac** messages illustrate the power de-rating is caused due to restriction of the maximum output AC current and power. The **VacH** message shows that the power de-rating is caused by the high AC voltage.

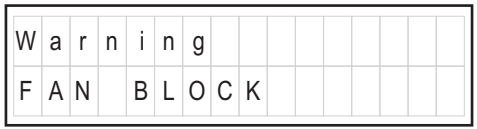


Warning Message:

There are three possible warning messages which be shown when situations occur in grid feeding mode. When EEPROM message displayed, the system has encountered a failure accessing to the EEPROM. For the COMM message, it represents failure of the communication function. For the FAN BLOCK message, it shows that the fan has stopped running. These warnings could be happening simultaneously.

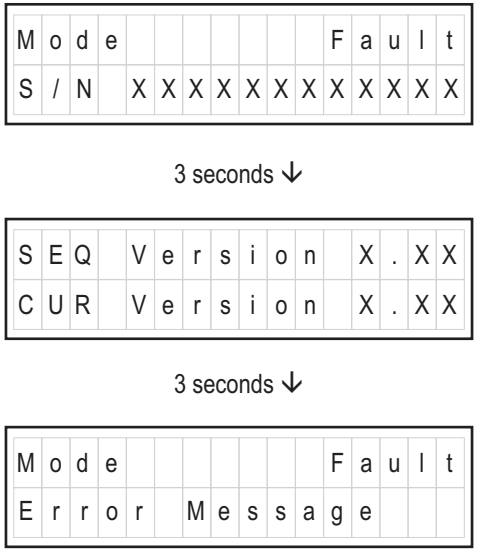






Fault Mode:

The messages for the fault procedure are as follows. It shows the fault mode, serial number of the inverter, software versions of the sequential (SEQ) and current (CUR) controllers and then the error messages which are listed in the Error Message Table on section 3.7.



There are several error messages that show the detailed conditions causing the system going into the Fault mode. Such as the messages shown below describe that the frequency on AC grid is too high (H) or too low (L). And after three (3) seconds, the message shows the present frequency and the frequency that caused the system to go into Fault mode.

M	o	d	e							F	a	u	l	t	
F	a	c	X												

X: H or L

3 seconds ↓

T	r	i	p		a	t			X	X	.	X	H	z	
P	r	e	s	e	n	t			X	X	.	X	H	z	

3 seconds ↓

The message below shows the AC voltage is too high (H) or too low (L). And after three (3) seconds, the message shows the present voltage and the voltage that caused the system to go into fault mode.

M	o	d	e							F	a	u	l	t	
V	a	c	X												

X: H or L

3 seconds ↓

T	r	i	p		a	t				X	X	X	.	X	V
P	r	e	s	e	n	t				X	X	X	.	X	V

3 seconds ↓

The message below shows the PV input voltage is too high.

M	o	d	e							F	a	u	l	t
V	p	v	H											

3 seconds ↓

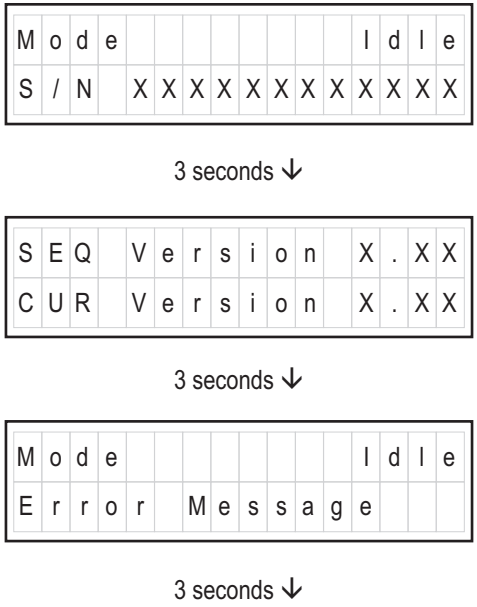
T	r	i	p		a	t				X	X	X	.	X	V
P	r	e	s	e	n	t				X	X	X	.	X	V

3 seconds ↓

Idle Mode:

The messages for Idle mode are as follows. It shows the operating mode, serial number of the inverter, software versions of the sequential

(SEQ) and current (CUR) controllers and then the error messages which are listed in the Error Message Table on section 3.7.



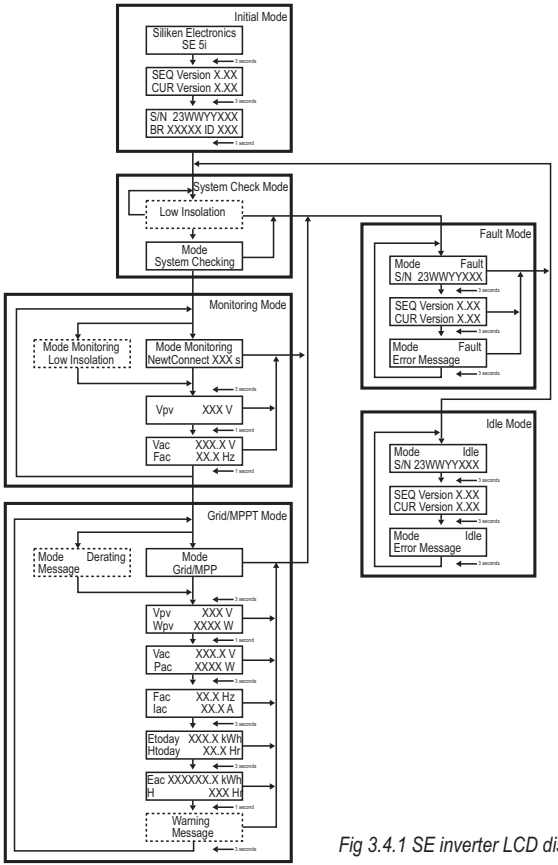


Fig 3.4.1 SE inverter LCD display lay-out

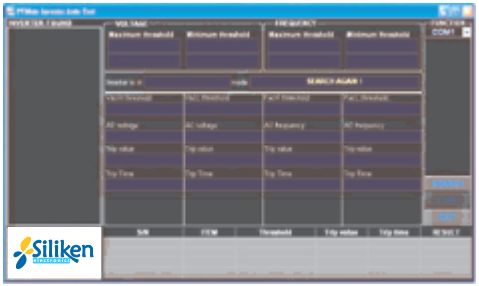
3.5 Auto Test

This Auto Test function is stipulated in accordance with the Italian Standard DK5940. It enables verification of the voltage and frequency monitoring function. The Auto Testing software as an accessory provided with the inverter should be installed on a PC connected up the inverter through the RS-485 (or RS-232) port. Once the software is installed successfully, there is an execution file “SE Inverter Auto Test” created in the “Start\Programs menu”.

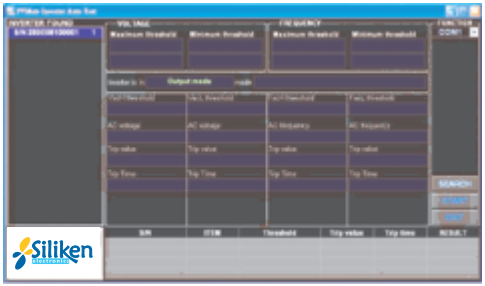
For the overall duration of this auto-test, the inverter never exports power to the AC grid. To begin with, the relays will close to conduct the max AC voltage threshold test as one of parts in auto-tests. Afterward the relays will open if this max AC voltage test is completed. Also, those remaining parts in auto-tests will repeat in this way in order to check the whole function and responses in case of fault condition. The Auto Test functionality and procedure is described as follows.

Double click the “SE Inverter Auto Test” and the software will search for all well-connected inverters with the PC; meanwhile the following messages are shown.

NOTE: On the screen it appears **“search again”** warning in case the inverter fails found. Please confirm the correctness of communication and then click the “SEARCH” button for one more try.



It shows the serial number and the status of the inverter when communicated successfully. Whichever the preceding mode it is, clicking the "**START**" button is going to turn the inverter into the "Monitoring mode" automatically.



Choose one inverter to run the Auto Test by highlight its serial number if more than one inverter is found. And then click the "**START**" button to start the Auto Test, which performs in order,

a. Maximum AC voltage threshold

b. Minimum AC voltage threshold

c. Maximum AC frequency threshold

d. Minimum AC frequency threshold

The standard threshold values and the trip time related to the specified sub test will be displayed on the PC screen before the Auto Test.

a. Maximum AC voltage threshold: 262 V ; < 0.1 s

b. Minimum AC voltage threshold: 188 V ; < 0.2 s

c. Maximum AC frequency threshold: 50.3 Hz ; < 0.06 s

d. Minimum AC frequency threshold: 49.7 Hz ; < 0.06 s

The slew rate of the threshold values, either increase or decrease, are ≤ 0.05 Hz/s for frequency and ≤ 1 V/s for voltage starting from the maximum (or minimum) threshold value. During the Auto Test the threshold value changes linearly and the measured values of the AC grid will be displayed on the PC screen.

The threshold will move from the maximum (or minimum) threshold value toward the measured value of the AC grid. While this match occurs the inverter will disconnect the AC line and recognize if it disconnects.

Once a sub test fails, the inverter will turn “Monitoring mode” into “Fault mode” and stop the test until the “**START**” button is clicked to restart again. If a sub test passes, the inverter will continue the remaining sub tests automatically after 5 seconds.

When the inverter is under Auto Test, the following message will be shown on the LCD.

A	u	t	o		T	e	s	t	i	n	g				

NOTE: If the Auto Test fails, the inverter will go into “Fault mode” and the error message will display on the LCD shown below.

M	o	d	e							F	a	u	l	t	
A	u	t	o	t	e	s	t		E	r	r	o	r		

3.6 Communication

There are two types of communication methods, RS-232 and RS-485 supported in the SE inverters that may be connected to an external computer or terminal equipped with either RS-232 and/or RS-485. Only one type of the communication can be used at a time. SE inverter will automatically switch to RS-232 or RS-485 depends on the external communication interfaces without manual setting. For the RS-485 interface, it allows multiple inverters that can be connected to an external computer. It allows only one inverter to be connected to an external computer if RS-232 interface is used. Please refer to the section 2.3, “Connection of the Communication Cable”, for the detail pin descriptions for both RS-232 and RS-485 interfaces.

3.7 Explanations of Error Messages

In the event of a fault, the inverter will stop feeding the AC power to the utility grid and display the error message on the LCD. Qualified service personnel shall do the analysis, measurement, and debug if needed according to the error message in order to resume normal conditions. It is recommended to screen out the fault condition(s) by referring to the table below and then remove the fault condition(s) to return normal condition and continue to feed AC power to the utility. Please contact Siliken Electronics or your service representative if the same error message is persistent.

Error Message	Description
GridNA	No AC voltage is detected on the grid side.
Drift Fac	Islanding is detected.
VacH	The AC voltage of utility grid is over the upper limit.
VacL	The AC voltage of utility grid is under the lower limit.
FacH	The frequency of AC voltage of the utility is over the upper limit.
FacL	The frequency of AC voltage of the utility is under the lower limit.
VpvH	The DC voltage of PV array is over the upper limit.
Imax AC	Over current on the AC side.

Error Message	Description
InvTempMax	The internal temperature of the inverter exceeded the safe operating limit.
Relay 1 Open	Relay 1 test open failed.
Relay 1 Close	Relay 1 test close failed.
Relay 2 Open	Relay 2 test open failed.
Relay 2 Close	Relay 2 test close failed.
MOV Fault,AC	High voltage protection function failed in AC side.
MOV Fault,DC	High voltage protection function failed in DC side.
GFDI	A grounding fault is detected. The ground fault fuse will be blown.
DCInjectCurH	Over DC current injected into the AC grid is detected.
VdcbusH	Internal DC bus voltage is over the upper limit.
Internal COMM	Internal communication failed.
Watchdog	Internal watchdog function triggered.
Idc Test	The DC injection current monitoring function failed.
Offset	Offset check for grid monitoring failed.
Temp. Sensor	The internal temperature sensor failed.
RAM Test	Memory failed
EEPROM Test	EEPROM test failed
System Error	The system failed.
Version Error	The firmware version is not correct.
CPU Delta Fac	Internal measurement comparison error or defective hardware.
CPU Delta Vac	
CPU Delta GFDI	
CPU Delta Idc	
IpvH	Over current on the DC side.
Driver Fault	Driver circuit or power device failed.
CalDataError	Calibration data is out of range.
CalDataLoss	Calibration data is lost.
Ibuck Over	Internal converter over current.
Converter Error	DC/DC converter hardware failed.
Autotest	Auto test failed.

4. Warranty Information

Warranty Period

A period of 5 years is warranted from the date of your purchase of the SE series Products.

Warranty Terms

SILIKEN ELECTRONICS, S.L. hereby provides this written Limited Warranty covering the Products with the models SE 2800E (-PG), SE 3800E (-PG), SE 4000E (-PG) and SE 5000E (-PG), and if the Buyer discovers and notifies SILIKEN in writing of any defect in material or workmanship within the applicable warranty period stated above, then SILIKEN may, at its option: repair or replace the Product; or issue a credit note for the defective Product; or provide the Buyer with replacement parts for the Product.

The Buyer will, at its expense, return the defective Product or parts thereof to SILIKEN in accordance with the return procedure specified below.

SILIKEN will, at its expense, deliver the repaired or replaced Product or parts to the Buyer.

Exclusion of Liability

Any warranty of SILIKEN will not apply if the Buyer is in default under the Purchase Order Agreement or where the Product, any part or its original label thereof is

1. Damaged by misuse, accident, negligence or failure to maintain the same as specified or required by SILIKEN.
2. Damaged by external hazard or force majeure such as lightning strikes, storm, and/or fire.
3. Damaged by modifications, alterations or attachments thereto which are not authorized by SILIKEN.

4. Transported, installed or operated contrary to this instructions of SILIKEN.

5. Opened, altered, modified or disassembled in any way without SILIKEN's consent.

6. Used in combination with items, articles or materials not authorized by SILIKEN.

SILIKEN reserves the rights to determine whether the problem exists within the Product. The Buyer may not assert any claim that the Products are not in conformity with any warranty until the Buyer has made all payments to SILIKEN provided for in the Purchase Order Agreement.

Product Return Procedure

On-site Inspection & Repair

If a Product requires warranty service, contact your merchant or SILIKEN directly. After your application is received, the service will be implemented by our qualified technician in the installation field. Problem isolation processes include,

1. Qualified service technician on site with digital measurement equipments, including but not limited to digital voltmeter and current clamp meter.

2. Isolation of the inverter from the external electrical environment under the guidance of a qualified SILIKEN service representative.

3. Full declaration of the environmental conditions currently in place and historically preceding the failure, including but not limited to the utility grid connection and PV generator array configuration.

What Comes to Your Notice before Return

In case the Product fails to function and requires a Factory Service after diagnosis, the Product could be sent back using the proper shipping box and the packing materials. A copy of the original purchase invoice is also required to be included in the package. In addition, here are

some documents which be attached with the return Product. Please provide as much detail as possible.

1. Model number and serial number shown on the label.

2. Fault message on the panel and how it reproduces.

3. Detailed descriptions before & after the fault condition and the utility grid system connected.

How Our Factory Service Goes On

1. Replace the defective Product with a new unit if it is purchased within 90 days.

2. Replace the defective Product with a refurbished unit if it is purchased after 90 days.

NOTE: All remaining warranty periods will remain effective for the replacement inverter or parts.

NOTE: Unauthorized returns will not be accepted and will be returned at the shipper's expense.

NOTE: All component replacement and its service labor costs are covered by the warranty in effect. Once the warranty expires, a Product found upon inspection by SILIKEN, to be in specification is subject to an evaluation fee and applicable freight charges, if any.

WARRANTY REGISTRATION FORM

It is very important to you that you register the product. Changes in product technologies as well as new developments in software and features may make it necessary for us to notice you the related information about your inverter. Please register immediately after purchasing.

Company :

Product Type :

City, State Zip :

Serial Number(s) :

Phone :

Date Installed :

E-mail :

System Description : PV array size/type, Connection…

Your Comment :

5.1 Outline Drawing

SE 2.8i-DM

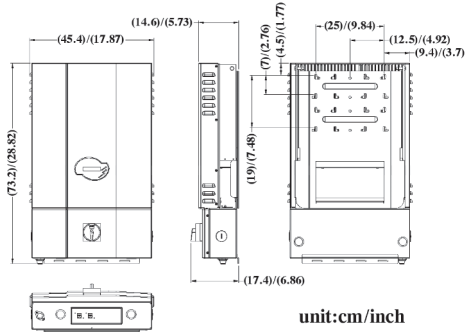


Fig 5.1.1 Outline Drawing of SE2.8i-DM

SE 2.8i-DS

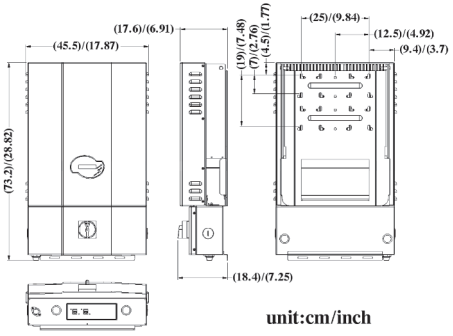


Fig 5.1.2 Outline Drawing of SE2.8i-DS

SE 2.8i-S

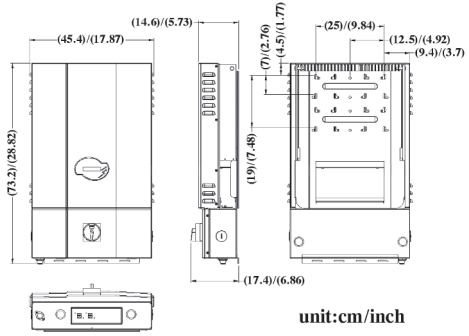


Fig 5.1.3 Outline Drawing of SE2.8i-S

SE 3.8i-DM

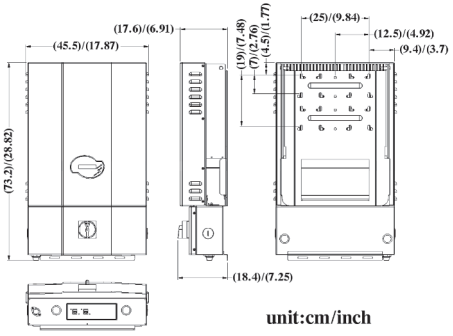


Fig 5.1.4 Outline Drawing of SE3.8i-DM

SE 3.8i-DS

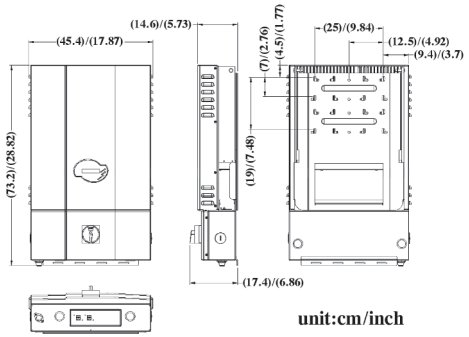


Fig 5.1.5 Outline Drawing of SE3.8i-DS

SE 3.8i-S

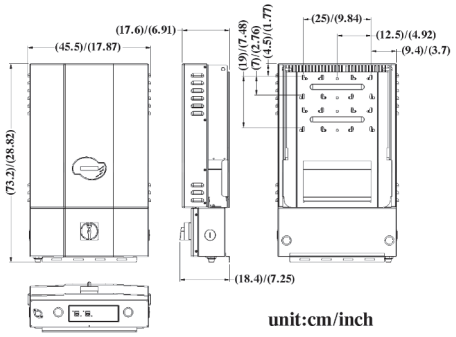


Fig 5.1.6 Outline Drawing of SE3.8i-S

SE 4i-DM, SE5i-DM

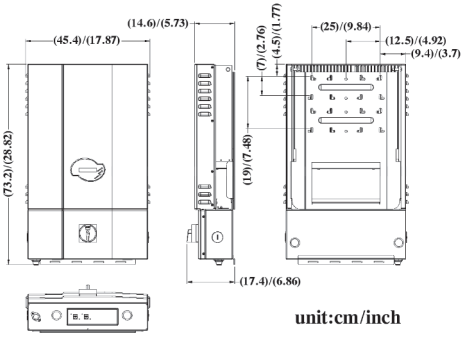


Fig 5.1.7 Outline Drawing of SE4i-DM, SE5i-DM

SE 4i-DS, SE5i-DS

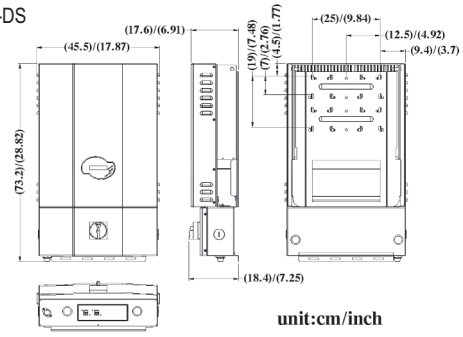


Fig 5.1.8 Outline Drawing of SE4i-DS, SE51-DS

SE4i-S, SE5i-S

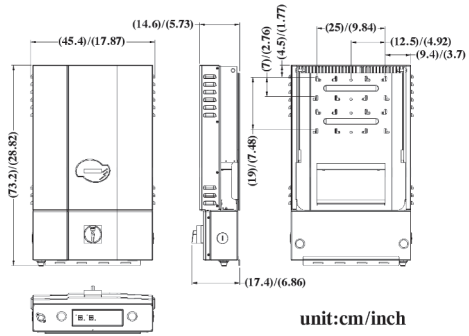


Fig 5.1.9 Outline Drawing of SE4i-S, SE5i-S

5.2 Efficiency

Efficiency of the SE2.8i

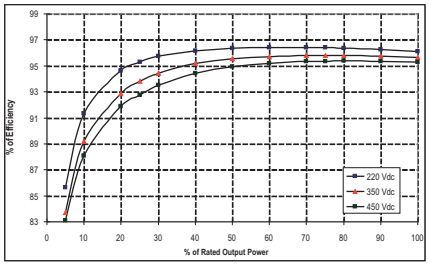


Fig 5.2.1 European Efficiency of the SE2.8i=95.4%

Efficiency of the SE3.8i

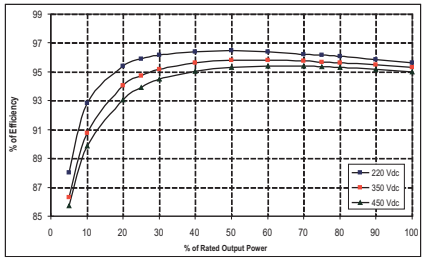


Fig 5.2.2 European Efficiency of the SE3.8i=95.7%

Efficiency of the SE4i

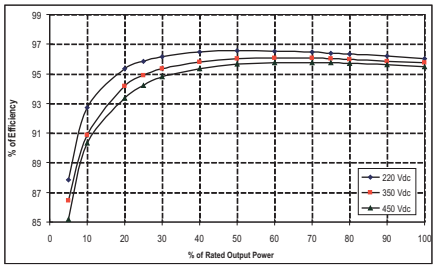


Fig 5.2.3 European Efficiency of the SE4i=95.8%

Efficiency of the SE5i

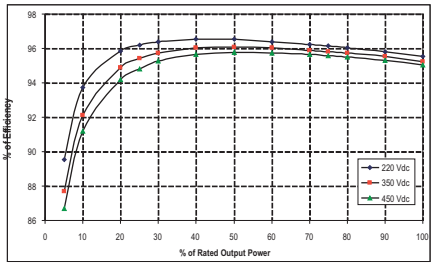


Fig 5.2.4 European Efficiency of the SE5i=95.8%

5.3 De-rating Operation

The occasions when the SE inverter will take into account and then regulate the output and/or restrict the input power to ensure the system is in a safe operation are described in detail below.

Temperature

The SE inverter will monitor the temperature on the heatsink. Once the temperature exceeds 78°C (172.4°F) the system will reduce the output power until the temperature drops under the critical value. The SE inverter will shut down the power output to the grid if the temperature reaches 82°C (179.6°F). If this occasion happens often, it is necessary to check whether the inverter is mounted at an appropriate place with good ventilation and not directly exposure to the sunshine.

Input DC current

When the input current from the PV strings is about to exceed the maximum limit, the SE inverter will restrict it to the operating limit in order to prevent damage to the inverter. If this occasion happens frequently, it is necessary to check whether the PV array is configured properly to supply the DC current within the maximum limit of the inverter.

Output AC power

The maximum power that the SE inverter feeds to the grid is limited according to the specifications listed in Section 1.2. Even if the output current does not up to the maximum current limit, the output power may still be limited in order to keep the output power within the maximum power limit. It often occurs in case the output voltage is higher then nominal AC voltage.

Output AC current

The maximum current that the SE inverter feeds to the grid is limited according to the specifications listed in Section 1.2. Even if the output power does not up to the maximum power limit, the output current may still be limited in order to keep the output current within the maximum current limit. It often occurs in case the output voltage is lower then nominal AC voltage.

Output AC voltage

When the inverter is connected to a grid system with longer or thinner wirings, its output voltage might be higher than the over voltage setting. This will cause disconnection due to the voltage deviation instead of abnormal voltage happened in the grid. SE inverter provides a setting of voltage quality monitoring which is less than the setting of over voltage. Once the AC voltage reach the voltage quality monitoring setting, SE inverter will restrict the output current to keep the AC voltage stay equal to or less than the setting of AC over voltage so that the inverter, instead of shut itself down, keeps output power to the grid although it is not the maximum output power.

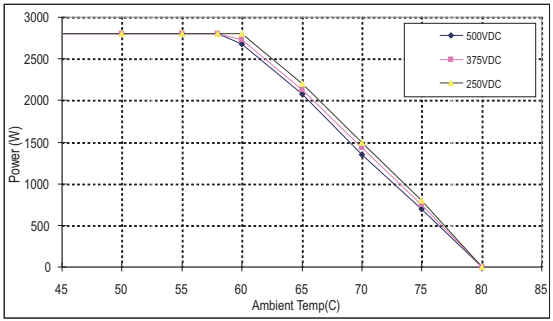


Fig 5.3.1 Temperature derating curve of the SE2.8i

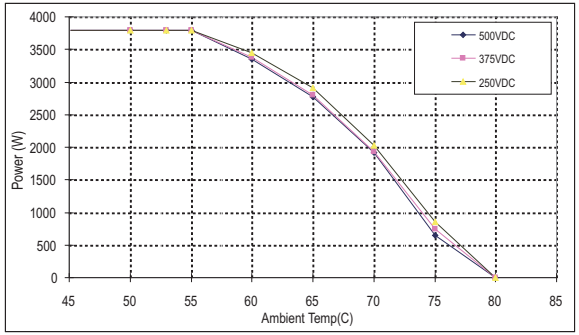


Fig 5.3.2 Temperature derating curve of the SE3.8i

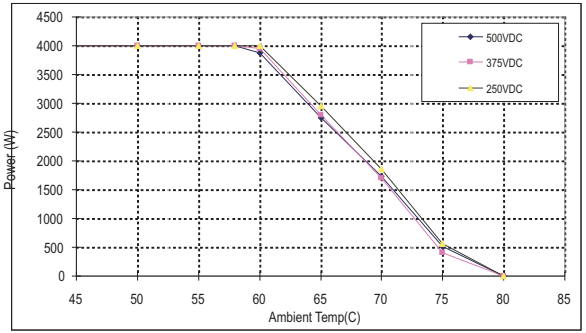


Fig 5.3.3 Temperature derating curve of the SE4i

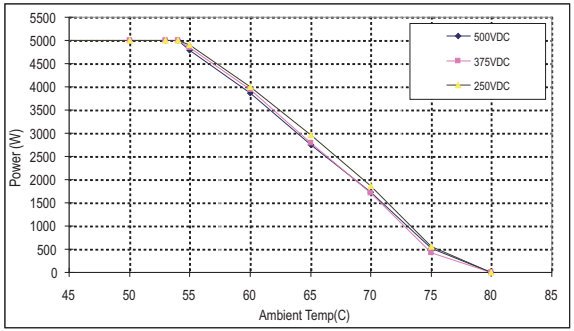


Fig 5.3.4 Temperature derating curve of the SE5i

5.4 Maintenance

5.4.1 Exchange of the GFDI Fuse.

As shown in the figure 5.4.1.1, turn the cap of the GFDI fuse holder counter anti-clockwise to open the cap and replace the GFDI fuse. Before replacing the fuse, turn off the DC/AC disconnect switch and the breakers and wait for at least 5 minutes for system to discharge.

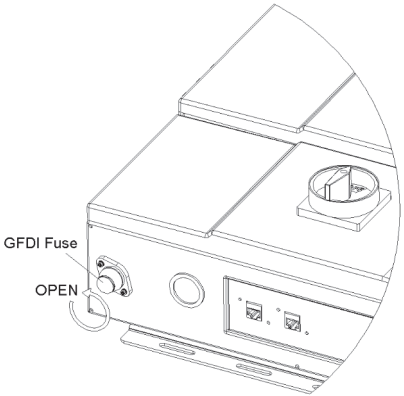


Fig 5.4.1.1 Open the cap of the GFDI fuse holder

1. Turn OFF the DC/AC disconnect switch and breakers.
2. Wait for at least 5 minutes.
3. Exchange the fuses.
4. Turn ON the DC/AC disconnect switch and breakers.

WARNING!

For continued protection against risk of fire, replace only with the same type and ratings of fuse (600 VDC, 1 A)!

5.4.2 Factory Service

Once the product is diagnosed requiring a Factory Service, the product could be removed and sent back using the original shipping box and the packing materials. A copy of the purchase invoice is also required to be included in the package.

Document

There are some documents must be attached with the return product. Please write as detail as possible.

1. Serial number and machine type of the inverter

2. Brief descriptions of connected system

3. Fault message(s) on front panel or fault condition(s)

4. Can the failure be reproduced? How to reproduce it?

The following sections will describe the steps to remove and then to hook back the inverter with the wiring box remaining on the wall.

5.4.2.1 Remove the Inverter

SE inverter is designed to be easily separated from the wiring box and removed from the mounting bracket. It must wait for at least five (5) minutes for system to discharge after DC/AC disconnect switch and breakers are switched OFF and before opening the front cover of the inverter to disconnect the wires. Both DC and AC wires that are disconnected from the inverter must be properly wrapped with insulated material. After the inverter is removed from the mount bracket, the through holes of the wires on top of the wiring box must be covered with the cover plate that is attached on top of the wiring box to prevent the box from the water drops causing current leakages.

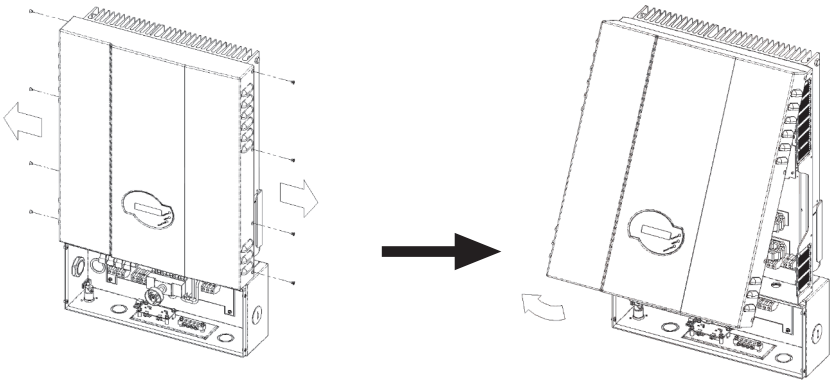


Fig 5.4.2.1.1 Remove the cover of the Inverter

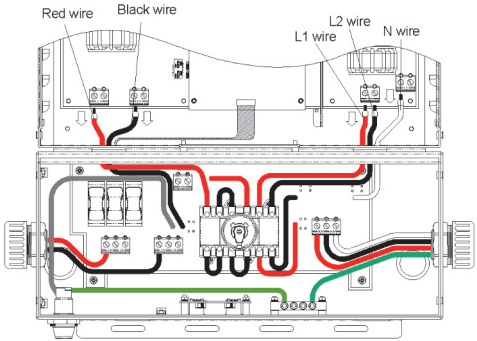


Fig 5.4.2.1.2 Remove the DC and AC wires

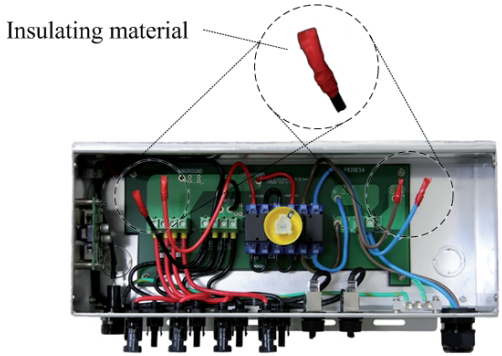


Fig 5.4.2.1.3 Keep the well-wrapped DC and AC wires in store in the wiring box

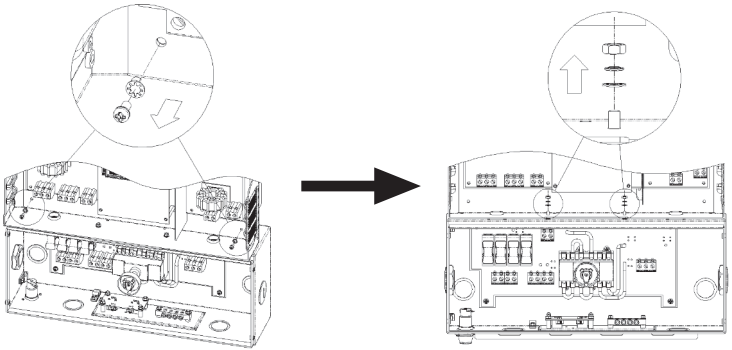


Fig 5.4.2.1.4 Remove the screws and nuts bonding between the inverter and wiring box

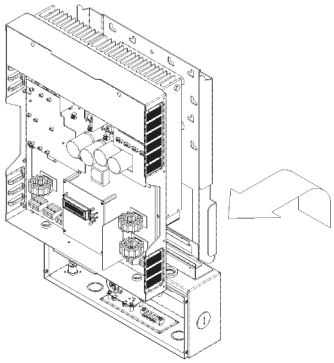


Fig 5.4.2.1.5 Un-hang the inverter carefully

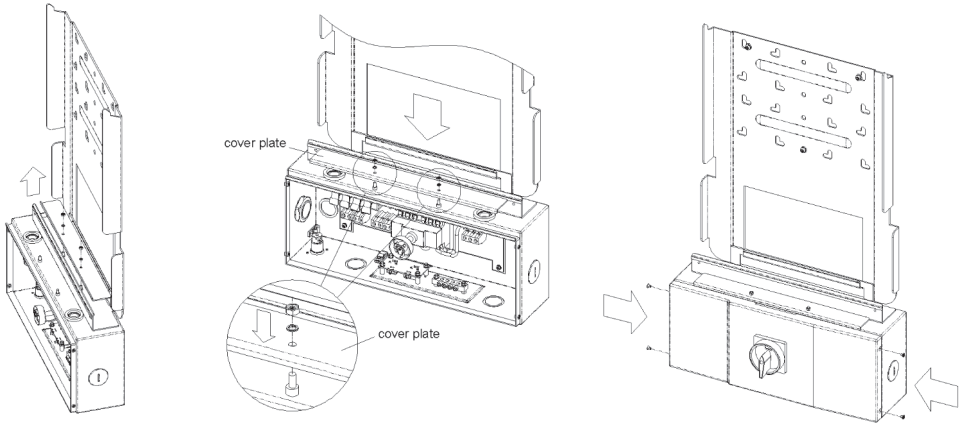


Fig 5.4.2.1.6 Locate the cover plate in place and fasten the screws

1. Turn the DC/AC disconnect switch to OFF position and turn off all breakers.
2. Wait for at least 5 minutes.
3. Remove the cover of the wiring box by following the steps described in section 2.3.
4. Remove the cover of the inverter as shown in the figure 5.4.2.1.1
5. Disconnect the red and black DC wires from the DCIN+ and DCIN- terminals, disconnect the brown and blue AC wires from the ACIN_L1, and ACIN_L2 terminal and disconnect the communication cable as shown in the figure 5.4.2.1.2.
6. All disconnected wires must be wrapped with insulated materials to prevent from the electric shock. Pull in those disconnected wires inside the wiring box as shown in the figure 5.4.2.1.3.
7. Loose the 2 screws by a cross driver and the other 2 nuts by a 7-mm wrench so that the inverter can be taken apart from the wiring box as shown in the figure 5.4.2.1.4.
8. Remove the inverter from the mounting bracket as shown in the figure 5.4.2.1.5.
9. Using the cover plate that is on top of the wiring box to cover the through holes of the wires as show in the figure 5.4.2.1.6.
10. Put the front cover of the wiring box back and fasten the screws.
11. Collect the removed screws and nuts in a plastic bag for the need of re-install the inverter in the future.
12. Keep the DC/AC disconnect switch and circuit breakers stay at the OFF position until the inverter is re-installed, all wires are connected correctly, front covers are put back and screws are fastened.

5.4.2.2 Re-install the Inverter

After re-installation of the inverter, all wires must be re-connected correctly before put the inverter back to work properly.

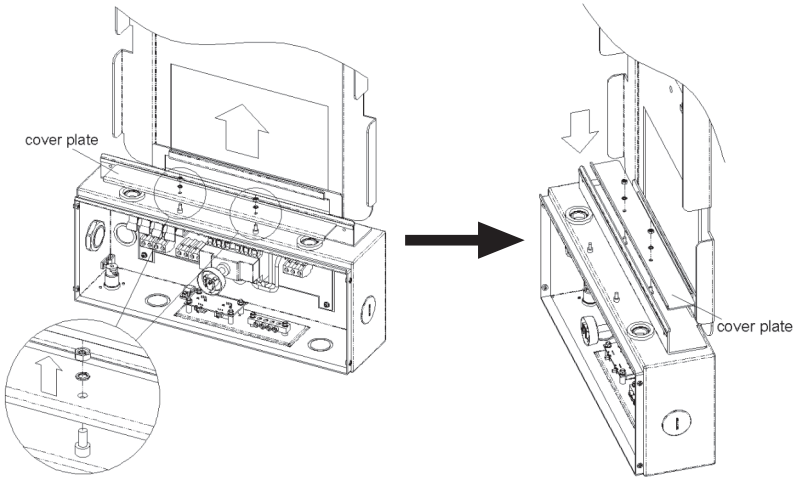


Fig 5.4.2.2.1 Re-install the cover plate and fix it on the top of the wiring box

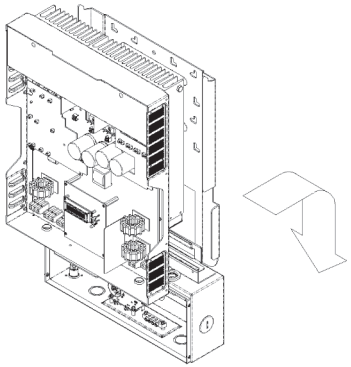


Fig 5.4.2.2.2 Hang the inverter into the mounting bracket carefully

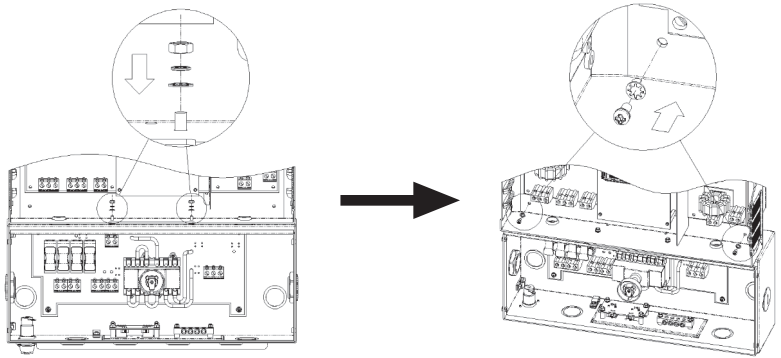


Fig 5.4.2.2.3 Fasten the screws and nuts bonding between the inverter and the wiring box for construction and grounding continuity

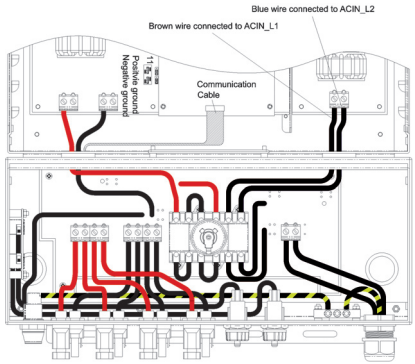


Fig 5.4.2.2.4 Connect the AC wirings to their correct terminals individually

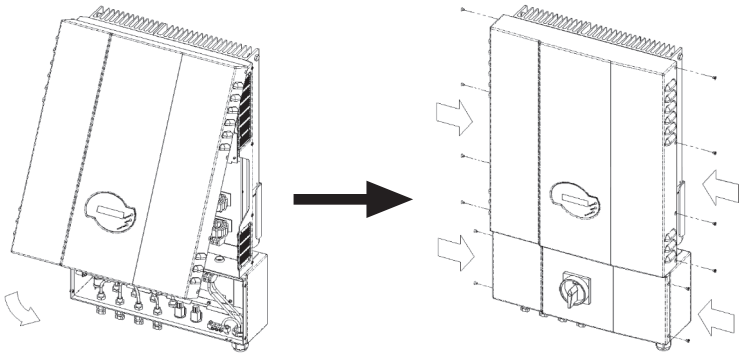


Fig 5.4.2.2.5 Fasten the screws of cover of the inverter first and the wiring box then

1. Turn off all DC/AC disconnect switch and breakers.
2. Remove the front cover of the wiring box by following the steps described in section 2.3.
3. Remove the cover plate used to cover the through holes of the wires and put it back to its original place as shown in the figure 5.4.2.2.1.
4. Remove the cover of the inverter and then hung it on the mounting bracket as shown in the figure 5.4.2.2.2.
5. Tighten the screws and nuts with a torque of 1.7Nm (15.6 in-lb) when performing the following items 6, 7 and 8.
6. Fasten the original 2 screws by a cross driver and the 2 nuts by a 7-mm wrench as shown in the figure 5.4.2.2.3.
7.If it is originally negative ground, then connect the red DC wire to the terminal labeled DCIN+ and connect the black DC wire to the terminal labeled DCIN- as shown in the figure 2.3.2.1.1. If it is a positive ground system, then connect the red DC wire to the DCIN- terminal and connect the black DC wire to the DCIN+ terminal as shown in the figure 2.3.2.2.1. Please refer to the section 2.3.2 for further details.
8. For the AC wire connections, the brown Vac wire shall be connected to the terminal labeled ACIN_L1, the blue Vac wire must be connected to the ACIN_L2 terminal as shown in the figure 5.4.2.2.4.
9. To connect the communication cable.
10. Put the covers of the inverter and wiring box back and fasten the screws as shown in the figure 5.4.2.2.5.
11. Turn ON the DC/AC disconnect switch and breakers.

WARNING!

PV arrays are always energized when exposed to light therefore hazardous voltage is still present on the terminal blocks and the PV string fuse holders even the DC/AC disconnect switch is switched OFF. Please cover the PV arrays with opaque (dark) materials during the inverter removal and absence until the inverter is hooked back and reconnected.

WARNING!

Hazardous voltage is still present on the device after disconnection of all PV DC inputs. Allow 5 minutes for the inverter to discharge

the energy stored in capacitors completely.

WARNING!

Must confirm that all DC and AC circuit breakers are turned off for at least five (5) minutes before opening the front covers of the inverter and the wiring box and disconnect the DC and AC wires between them. The wires been disconnected must be wrapped with an insulated material to prevent staff from the electrical shock.

WARNING!

After the inverter is removed from the mounting bracket, the through holes of the wires on top of the wiring box must be covered with the cover plate that is attached on top of the wiring box to prevent the box from the water drops causing current leakages.

WARNING!

Not to keep any spare parts inside the wiring box.

Notes

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